Intercept of USSR Missile Transmissions

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~~Top Secret Daunt~~

A discussion of possible improvements in our means of intercepting transmissions by Soviet missiles.

INTRODUCTION

Intercept of electromagnetic radiations emitted by foreign missiles is of great importance to any nation. [redacted]

Methods which may be utilized for VHF reception include:

a. Natural phenomena of low probability

(1) meteorological ducting
(2) the ionized aurora
(3) sporadic E
(4) transequatorial F
(5) antipodal propagation

[redacted]

The first group considers those natural events which enhance signal intensities in the frequency range 50–220 mc/s at considerable distances from the transmitter. Their presence greatly increases the usual range of reception, even with low transmitted powers. Although full knowledge of the occurrence, movement, location, and reflectivity of some phenomena is not available today, some information on their general behavior in relation to time of day, season, and sunspot number is at hand.

[redacted]

A more detailed discussion of the several methods is presented below.

2. NATURAL PHENOMENA OF LOW PROBABILITY

Several natural events occurring with fair frequency make possible the rather efficient propagation of radio waves in the frequency range 50–220 mc/s. An indication of the phenomena involved, the frequencies possible, the distance coverage, and the most favorable period of occurrence is shown in Table I.

(b)(1)
(b)(3)-50 USC 403
(b)(3)-18 USC 798

TABLE I

Natural Phenomena Enhancing Signal Intensities

Phenomenon	Maximum Freq. (mc/s)	Distance (km)	Maximum Occurrence	
Sporadic E	50–150	650–3000	Summer (June-Aug)	[redacted]
Meteorological ducting	100–3000	600–3500 Best over sea	Summer (June-Aug)	
Ionized aurora[1]	50–220	400–2000	Spring, Fall	
Trans-equatorial F_2	50–70	2500–10,000 N–S over equator	Spring, Fall (Mainly evening)	
Antipodal propagation	5–30	31,600–32,000	Anytime	

[redacted]

2.1 METEOROLOGICAL DUCTING

Ducting is very dependent upon the meteorological situation and is found whenever permitted by existing moisture and temperature gradients. Generally, the necessary meteorological conditions—inversions of temperature and water vapor—occur most frequently and with greatest persistence during the summer, when the vapor pressure of the air is high.

[redacted]

[redacted] In general, the probability of ducts existing for a given radio frequency increases as the frequency is increased.

2.2 THE IONIZED AURORA

Auroral propagation refers to radiowave propagation via reflection from the ionized aurora. As an indication of the frequency range supported, it may be noted that at 600 mc/s high-power radar transmissions have been thus reflected. Successful communication by this method has also taken place at frequencies of 50–220 mc/s.

[redacted]

However, even if these conditions are fulfilled, reception may occasionally be unsatisfactory. Although signals reflected from the aurora can be remarkably stable, sometimes the fading and flutter are so severe that voice, for example, becomes unintelligible. It should also be recognized that, even with conditions of perfect reception, the ionized aurora suffers a geographic limitation. [redacted]

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Fig. 1.

(b)(1)
(b)(3)-50 USC 403
(b)(3)-P.L. 86-36

2.3 SPORADIC E

Sporadic E has its greatest prevalence during summer (June, July, and August in ascending order). [redacted] During June, the average occurrence of E_s is about 7% of the total number of hours, and may exceed 35% of the evening hours. The annual occurrence is unpredictable; the incidence is often very high one year and very low the next.

It has been found that the efficiency of reflection decreases with increasing radio frequency. Thus, radio amateurs extensively use 50 mc/s and, to a much lesser extent, 144 mc/s for two-way communications (to 4000 km) whenever E_s is present. Although its occurrence is indeed sporadic, E_s reflectivity at 50 mc/s has on many occasions permitted 4000 km contacts using radiated powers of only 10 watts.

[redacted]

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(b)(3)-50 USC 403
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2.4 TRANSEQUATORIAL F

Transequatorial F describes very-long-distance propagation, at frequencies near 50 mc/s, from the southern to the northern hemisphere. Although initially explored by radio amateurs making contacts between South America and the U. S., its availability between Africa and Western Europe, Japan and Australia, and Japan and Argentina has now been studied. Roughly speaking, such propagation takes place mainly [redacted] and extends more infrequently to higher latitudes. The efficiency of reflection is surprisingly good; distances of 9,000 km have been spanned with transmitter powers of 100 watts.

The deficiencies of transequatorial F are similar to those of sporadic E. It has been found to occur principally during the equinoctial periods, and then mainly in the evening hours. [redacted]

2.5 ANTIPODAL PROPAGATION

Antipodal propagation is most effective in the HF range and close to the maximum usable frequency. The signal is received on the globe at a point diametrically opposite to the transmitter. Although it is still under investigation and requires more study, operational factors may make it desirable to proceed at once to a test in the field. It has recently been found to occur at a frequency of 108 mc/s.

2.6 SUMMARY

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[redacted]

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